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2,134,083

CONTROL MECHANISM FOR GAS BURNERS

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2 Sheets-Sheet 1

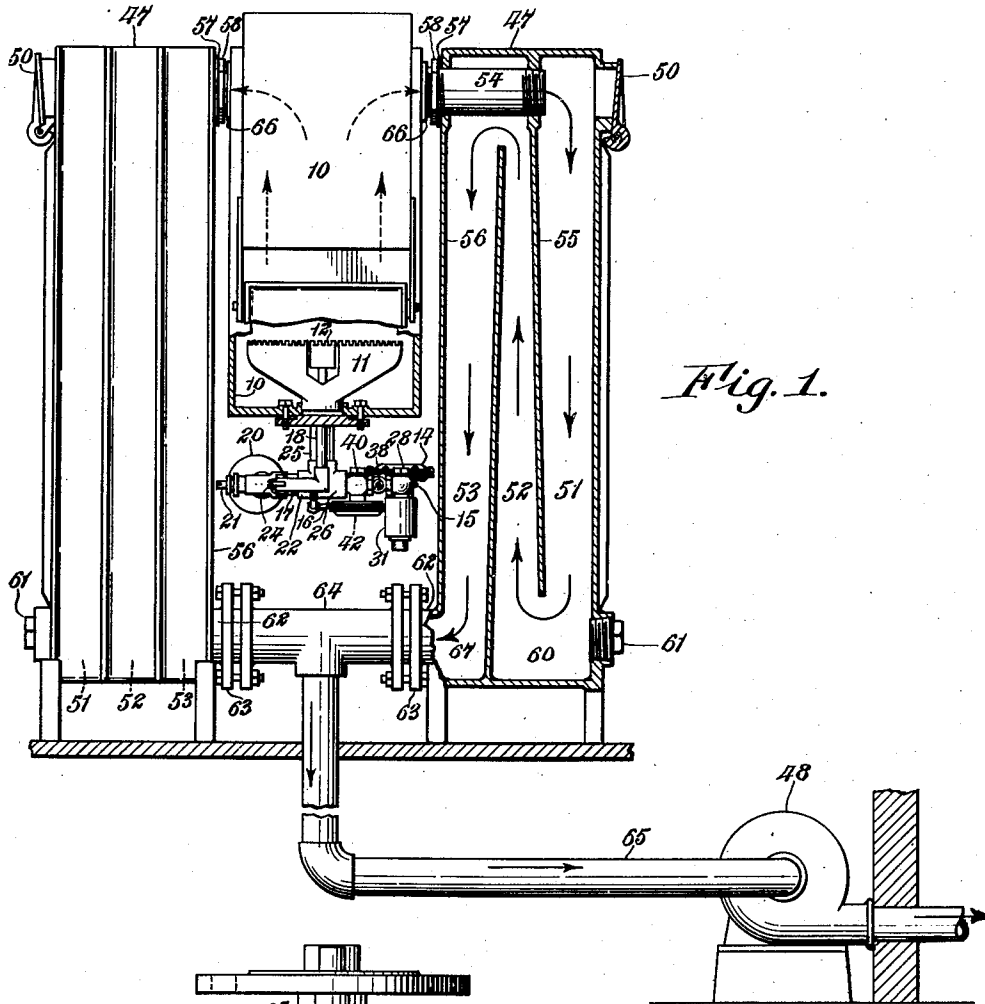
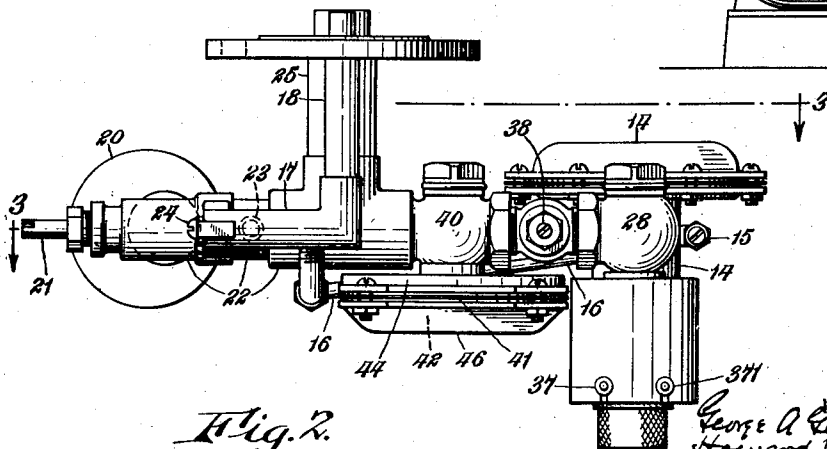


Fig. 2.

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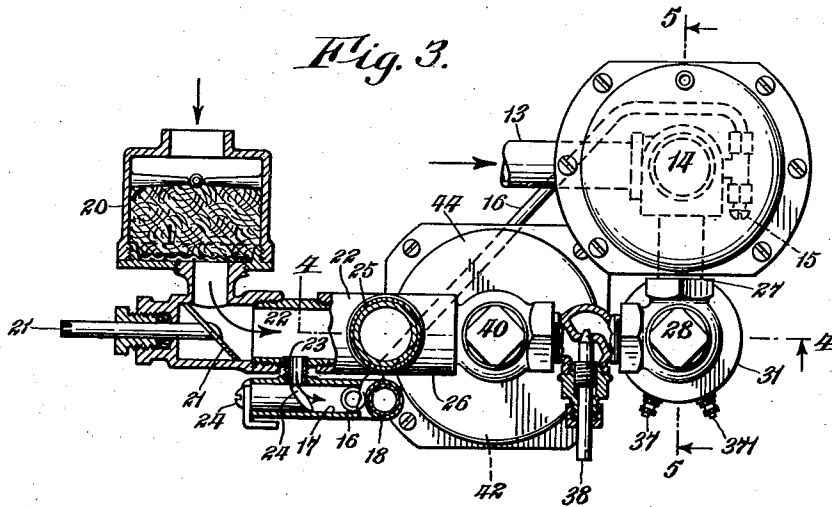
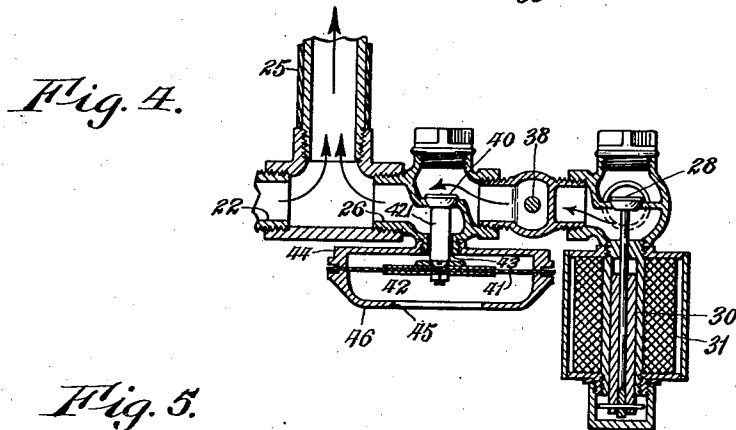
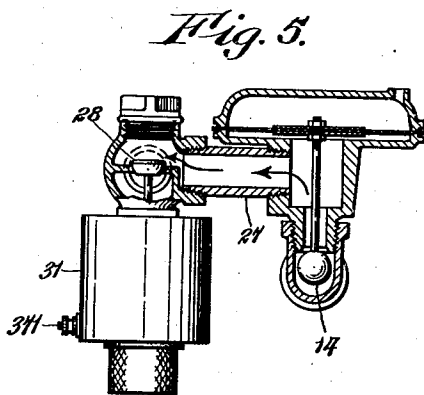
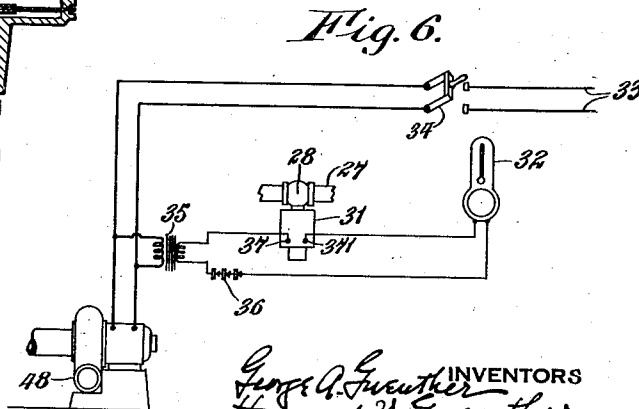
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CONTROL MECHANISM FOR GAS BURNERS

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2 Sheets-Sheet 2



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CONTROL MECHANISM FOR GAS BURNERS

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3 Claims. (Cl. 126-91)

This invention relates to a gas heater and more particularly to a control system for that type of gas heater in which the burner is located in a combustion chamber that is maintained under a partial vacuum.

One of the objects of the invention is to provide a gas heater which is reliable and quiet in operation irrespective of its size or of how many other heaters it is operating in conjunction with.

Another object of the invention is to force the gases of combustion to deliver their heat to the various conduits of the radiator sections irrespective of whether the flow of said gases is downward or upward.

Still another object of the invention is to provide a gas burner which will not readily become fouled up and which will, at the same time, have a uniform mixture of air and gas at all parts of the burner head.

Numerous other collateral objects of the invention and practical solutions therefor are disclosed in detail in the herein patent specification wherein:

Fig. 1 is a diminutive side elevation, partly in section, of a complete gas heater, having our invention incorporated therein.

Fig. 2 is a side elevation of the gas burner and associated parts.

Fig. 3 is a horizontal section through said gas burner, taken on line 3-3, Fig. 2.

Fig. 4 is a fragmentary, longitudinal, vertical section through the gas burner, taken on line 4-4, Fig. 3.

Fig. 5 is a transverse, vertical section through the gas burner, taken on line 5-5, Fig. 3.

Fig. 6 is a wiring diagram illustrating how the heater is electrically connected with other parts of the heating apparatus.

Similar characters of reference indicate like parts in the several figures of the drawings.

In its general organization, the present invention comprises a gas fired combustion chamber which is maintained at a sub-atmosphere pressure by a suitable suction pump, the heat which is evolved in said combustion chamber being transferred to the point needed by taking the gases of combustion as they emerge from the combustion chamber and passing them through a number of radiator sections before going to the suction pump. The operation of the unit is controlled by a suitable thermostat which actuates a gas cock which controls the flow of gas to the gas burner, said gas cock having only two positions, namely fully open or fully closed, said positions being dependent upon the requirements

of the thermostat. The customary pilot light is used to light the main burner, and suitable provision is made to prevent any gas from going to the main burner head in the event that the suction pump should fail. Suitable provision is also made to keep the pilot light burning at all times, so as to ensure that no gas will pass out of the main burner head without become ignited.

In apparatus of this type, as previously constructed, the operation of the larger heating units was fairly reliable and satisfactory but the operation of the smaller units was not. In addition to this, the radiator sections of the heating units of all sizes were inefficient as to thermal transfer. In addition, the radiator sections required frequent cleaning out and this operation was excessively arduous and unsatisfactory. Also the older type of gas heaters were unsafe to operate under certain conditions, and did not burn with an even flame on the entire surface of the burners.

In the present invention these disadvantages have been successfully overcome in actual practice by heaters constructed as follows:

In the combustion chamber 10 is mounted a main burner head 11 and a pilot burner head 12. The latter is kept burning at all times by being supplied by a suitable mixture of gas and air. The gas for said pilot is supplied from a main gas supply pipe 13 which feeds it to a pressure equalizing valve 14. The latter operates in the usual and well known manner to hold back the gas whenever its pressure rises beyond a certain predetermined point, in the manner shown and described in detail in Patent No. 1,940,587, issued to one of the herein co-inventors, George A. Guenther. From this pressure equalizing valve the pilot gas passes through a needle valve 15, where its amount of flow is regulated, and through a feed tube 16 into a pilot mixing chamber 17 where it is mixed with a suitable proportion of air and passes up a pilot riser tube 18 to aforesaid pilot burner head 12.

The air for both the pilot burner head 12 and the main gas burner head 11 is brought in through a main air cleaner 20, and passes through a main, air-adjusting valve 21, and thence into a main air duct 22. A portion of the air at this point is bled off through a bleeding nipple 23, and passes through a pilot air adjusting valve 24 into aforesaid pilot mixing chamber 17 where, as previously described, it mixes with the pilot gas and passes to the pilot burner head 12. The main body of air in the main air duct 22 is con-

veyed to the base of a vertical, main, burner pipe 25 where it mixes with gas from a main gas duct 26 and and is mixed therewith and the mixture then passes upwardly through said main burner pipe 25 to the main burner head 11. It should be noted that the main air duct 22 and the main gas duct 26 are axially in alignment with each other. This means that the gas and air impact upon each other face to face at this point and are thereby very intimately mixed without requiring any vanes or other protuberances in the bore of either of said ducts or of the main burner pipe 26. In other words, the bores or both of these ducts and the bore of the main burner pipe 25 may be constructed as smooth as may be desired to prevent the accumulation of dirt and scale, and yet the air and gas be so intimately mixed that the gas-air mixture at the main burner head 11 be absolutely uniform. This is a considerable improvement over previous burners in which a certain amount of more or less raw gas was found to creep up one or other side of the burner pipe and, as a consequence, to either burn at the burner head with a dirty flame at some spots, or to require such an excess of air in the mixture as to seriously reduce the thermal efficiency of the burner.

Gas for the main burner head 11 is led from aforesaid pressure equalizing valve 14 through a nipple 27 to a solenoid-actuated control valve or gas cock 28. This gas cock has only two positions, namely, a fully closed position (as shown in the drawings) and a fully open position.

This gas cock is actuated in the usual and well known manner by a soft-iron, cylindrical core 30 which is energized to open the gas cock 28 whenever current is fed through the solenoid coil 31 by the closing of the switch contacts of the usual thermostat 32, as shown in Fig. 6. The electrical energy which is adapted to energize this solenoid coil 31 is preferably fed from the electric power line 33, through a main electric control switch 34, and through a transformer 35 and rectifier 36 to the thermostat 32 whose switch contacts are in series with the contacts 37, 371 of the solenoid coil 31.

Whenever the gas cock is opened by the thermostat 32, gas is allowed to pass to a manually adjustable needle valve or gas regulating valve 38, the passage of gas through which is sufficiently constricted to warrant this valve as being broadly considered an orifice, as indeed it actually would be if said valve were so constructed as to not be adjustable. The present disclosure shows an adjustable valve but it is to be understood that the invention covers the use of a "metered" hole or other orifice, if so desired.

From this gas regulating valve 38 the gas passes to a suction safety valve 40 which, when in its open position, allows the gas to pass to the main gas duct 26 where it is mixed with air from the main air duct 22, as previously described. Said suction safety valve 40 is actuated by a flexible diaphragm 41 which is arranged in a diaphragm chamber 42 and is connected with the suction safety valve 40 by a shank 421. This shank fits sufficiently closely in the opening 43 of the upper wall 44 of the diaphragm chamber 42 to constitute a restricted tubular connection between the main gas duct 26 and the upper half of said diaphragm chamber. This restriction is sufficiently small in cross sectional area to prevent any fluttering of the suction safety valve 40 but is, at the same time, sufficiently large to ensure that the pressure in the upper half of the diaphragm chamber 42 is

substantially identical with the pressure existing at that moment in the main gas duct 26 and in the main burner pipe 25. The lower half of the diaphragm chamber 42 is always maintained at atmospheric pressure by the provision of a large opening 45 formed in the lower wall 46 of the diaphragm chamber.

The reason for this suction safety valve 40 is as follows: When the heater is in normal operation, all products of combustion are drawn out of the combustion chamber 10 and through a pair of radiator sections 47 by a suitable induced draft fan or suction fan 48. This fan is wired in parallel across the electric power line 33, as shown in Fig. 6, and hence operates constantly, from the time that the heating unit has been put into service, by the closing of the main electric switch 34. In the event, however, that the suction fan 48 should fail to function, then, as a consequence, the pressure in the combustion chamber 10 and in the upper half of the diaphragm chamber 42 will rise. This will allow the suction safety valve 40 to drop, and to thereby close off all gas flow through the heating unit except that to the pilot burner head 12. Thereby the combustion chamber 10 will be prevented from being burned out as a result of its heat not being properly drawn off by the suction fan. At the same time any carbon dioxide blanketing of the pilot burner head 12 is prevented by the action of gravity in opening a pair of safety vent doors 50 which have erstwhile been held inwardly in their closed position against the action of gravity by the sub-atmospheric pressure in the radiator sections 47.

In previous types of heaters of this same general character, the suction safety valve 40 has been placed in the gas line ahead of the gas regulating valve 38. This has been found only to act reliably, especially in the case of the large heating units, when the gas regulating valve 38 was opened quite wide. But when said gas regulating valve was closed to any considerable extent from its fully open position, then the sudden opening of the gas cock 28 would cause a wave of gas under pressure to be dashed against the gas regulating valve 38 which, being partially closed, would be too small to let the wave pass quickly through, thereby causing said wave to be reflected backwardly against the upper face of the diaphragm of the safety suction valve 40. This pressure against the top of said diaphragm would cause said diaphragm to drop, and this would cause the safety suction valve 40 to close. This closing would allow the pressure above the diaphragm to be released through the regulating valve and, due to this drop in pressure above the diaphragm, the safety suction valve 40 would again open. The result of this cycle of operations was a sharp fluttering of the safety suction valve of each heating unit whenever the gas regulating valve 38 was turned down to any considerable extent. This was particularly objectionable where a considerable number of heating units were connected together, because it would sometimes set up periodic vibrations or so-called hammer in the entire system and would sometimes even be violent enough to snuff out one or more of the pilot lights.

In the present invention the gas regulating valve 38 is placed between the gas cock 28 and the suction safety valve 40. With this setup, any surge of gas from the suddenly opened gas cock 28 is unable to be reflected back to the suction safety valve 40.

The suction fan 48 causes the heated gases of combustion in the combustion chamber 10 to be

drawn into the two radiator sections 47. Each of these sections consists preferably of an odd number of vertically disposed, radiator conduits arranged side by side. In the herein disclosure each radiator section consists of three radiator conduits, namely, an outer conduit 51, an intermediate conduit 52, and an inner conduit 53. The gases of combustion are conveyed directly from the top of the combustion chamber 10 to the top of each of the outer radiator sections 51 by a horizontal, radiator, inlet pipe 54. This inlet pipe is threaded at its extreme outer end into the partition 55 which forms the inner wall of the outer radiator conduit 51. The inner end of said inlet pipe 54 passes through the inner wall 56 of its companion radiator section and is connected in a gas-tight manner therewith by a soft gasket 57 which bears against the outer face of said inner wall 56 and is held firmly thereagainst by a packing nut 58 which is threaded onto the inlet pipe 54.

The outer conduit 51 is shown as being of tapered form with its small end down. This is advantageous in that it ensures that the gases of combustion will come into intimate contact with both the partition 55 and with the outer wall of the radiator section. This tapered form of conduit is not, however, essential in the case of such a downdraft conduit as this outer conduit 51, as the flow of gases in this particular case is contrary to the upward buoyant force of the hot gases and hence said gases are bound to firmly impinge against the walls of said outer conduit 51 even though said conduit has parallel walls or is tapered with the small end up.

The factors affecting the intermediate conduit 52 are, on the other hand, considerably different, because this particular conduit 52 is an updraft conduit in which the flow of gases is assisted by their buoyancy. If this conduit were bounded by parallel vertical walls or if it were tapered with the small end down, there would be a tendency, due to the buoyancy of the hot gases, to rapidly pass up the central part of the conduit without touching the side walls. The arrangement shown prevents such an action by having the conduit 52 of tapered form with the small end up. With such a construction the hot rising gases, instead of being all capable of direct vertical movement, are caused to impinge on the tapered conduit walls and to thereby be enabled to give up their heat to said walls.

It will be noted that the bottom end of the partition 55 stops considerably short of the floor of its companion radiator section. This enables dirt from both the intermediate, updraft conduit 52 and the outer, downdraft conduit 51 to fall into the one sump 60 which is of such ample capacity as to not require very frequent cleaning. When it does require cleaning, this may be effected readily through the threaded dirt plug 61. It is to be noted that most of the dirt in each radiator section will be deposited in its companion sump 60 and that, therefore, the radiator sections can be cleaned quite thoroughly without the need of dismantling them.

The upper end of the intermediate conduit 52 communicates with the upper end of the inner conduit 53. The latter is a downdraft conduit and hence, although preferably of tapered form with the small end down, as shown, may be of any other desired shape, just as in the case of the outer, downdraft conduit 51. The lower end of said inner conduit 53 opens into a short, integral pipe 62 which is connected by a union 63

with a manifold pipe 64. The central part of said manifold pipe 64 is connected to a suction pipe 65 which conveys the cooled-off gases to the suction fan 48 which is usually located in the basement of the building.

Ordinarily when cleaning the heating unit, both the upper unions 66 and the lower unions 63 are uncoupled. Dirt in the sump 60 is removed by unscrewing the dirt plug 61, as previously described, while dirt in the sump 67 at the lower end of the inner, radiator conduit 53 is removed through the short pipe 62. This eliminates the need of a special dirt plug to enable said sump 67 to be cleaned out.

We claim as our invention:

1. A control mechanism for a vacuum gas heater having a combustion chamber, a burner in said chamber and an exhaust device connected with said chamber, comprising a gas supply conduit connected with said burner, a suction operated safety valve arranged in the outlet portion of said conduit adjacent to said burner, an electrically operated thermostatic control valve arranged in the inlet portion of said conduit, and a manually adjustable regulating valve arranged in said conduit between said safety valve and said control valve.

2. A control mechanism for a vacuum gas heater having a combustion chamber, a burner in said chamber and an exhaust device connected with said chamber, comprising a gas supply conduit connected with said burner, a suction operated safety valve arranged in the outlet portion of said conduit adjacent to said burner, an electrically operated thermostatic control valve arranged in the inlet portion of said conduit, a manually adjustable regulating valve arranged in said conduit between said safety valve and said control valve, and an automatic reducing valve arranged in the inlet portion of said conduit in advance of said electrically operated valve.

3. A control mechanism for a vacuum gas heater having a combustion chamber, a burner in said chamber and an exhaust device connected with said chamber, comprising a gas supply conduit connected with said burner, a suction operated safety valve arranged in the outlet portion of said conduit adjacent to said burner, an electrically operated thermostatic control valve arranged in the inlet portion of said conduit, a manually adjustable regulating valve arranged in said conduit between said safety valve and said control valve, and an automatic reducing valve arranged in the inlet portion of said conduit in advance of said electrically operated valve, said suction valve including a movable closure member and a diaphragm which is responsive to the effect of said exhaust device for causing said suction valve to open when said exhaust device is in operation and to close when said exhaust device ceases to operate, said electric control valve being responsive to an electric thermostat for causing said control valve to open when the temperature is below normal and to close when the temperature is above normal, and said reducing valve being responsive to variations in the pressure under which gas is supplied to said conduit for causing said reducing valve to move toward its fully closed position as the pressure of the gas in the supply rises and to move toward its fully open position as the pressure of the gas in the supply drops.

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